CLAIMS

1. An optical amplifying repeater apparatus characterized in that the apparatus comprises

an input port to which a plurality of light signals multiplexed in wavelength are inputted,

a first fixed-gain optical amplifier for amplifying the wavelength-multiplexed light signals inputted through said input port with a predetermined gain,

an adjustable optical attenuator for attenuating the wavelength-multiplexed light signals by a predetermined factor after amplification through said first fixed-gain optical amplifier,

an optical demultiplexer for demultiplexing said wavelength-multiplexed light signals outputted from said adjustable optical attenuator into a plurality of individual light signals of discrete wavelengths, respectively,

fixed-gain optical amplifiers #1; #n for amplifying said plurality of individual wavelength-demultiplexed light signals outputted from said optical demultiplexer with a predetermined gain,

a monitoring light branching device connected to one of outputs of said second fixed-gain optical amplifiers #1; #n for extracting a part of a specific monitoring light signal,

an optical multiplexer for multiplexing the individual light signals outputted from said second fixed-gain optical amplifiers #1; #n, respectively, for thereby outputting multiplexed light signals, and

an adjustable attenuator control circuit for detecting output power of said monitoring light branching device to thereby control the attenuation factor of said optical attenuator so that said detected output power assumes a constant value.

2. An optical amplifying repeater apparatus characterized in that the apparatus comprises

an input port to which a plurality of light signals

multiplexed in wavelength are inputted,

a first fixed-gain optical amplifier for amplifying the wavelength-multiplexed light signals inputted through said input port with a predetermined gain,

an optical demultiplexer connected to output of said first fixed-gain optical amplifier for demultiplexing said wavelength-multiplexed light signals into a plurality of individual light signals of respective wavelengths,

adjustable optical attenuators #1; #n for attenuating the outputs of said optical demultiplexers, respectively, by a predetermined factor,

fixed-gain optical amplifiers #1; #n for amplifying said plurality of light signals outputted from said adjustable optical attenuators with a predetermined gain,

monitoring light branching devices connected to outputs of said fixed-gain optical amplifiers #1; #n for extracting parts of specific monitoring light signals #1; #n, respectively,

an optical multiplexer for multiplexing the outputs of said fixed-gain optical amplifiers #1; #n to thereby output multiplexed light signals, and

adjustable attenuator control circuits #1; #n for detecting output powers of said monitoring light branching devices to thereby control the attenuation factor of said optical attenuators so that each of said detected output powers assumes a constant value.

3. An optical amplifying repeater apparatus set forth in claim 1, characterized in that said first fixed-gain optical amplifier comprises

an optical fiber serving as a transmission line,

a pumping light source for inducing stimulated Raman amplifying action internally of said optical fiber in wavelength bands of said plurality of wavelength-multiplexed light signals, and

an optical coupling device for coupling the output of

said pumping light source with said plurality of wavelength-multiplexed light signals.

4. An optical amplifying repeater apparatus set forth in claim 1, characterized in that said first fixed-gain optical amplifier comprises

an optical fiber doped with a rare-earth element or alternatively a transition metal,

a pumping light source for inducing amplifying action under stimulated emission internally of said optical fiber in wavelength bands of said plurality of wavelength-multiplexed light signals, and

an optical coupling device for coupling the output of said pumping light source with said plurality of wavelength-multiplexed light signals, wherein said optical fiber doped with said rare-earth element or alternatively said transition metal is operative in an unsaturated region.

5. An optical amplifying repeater apparatus set forth in claim 1, characterized in that said fixed-gain optical amplifier #1; #n comprises

an optical amplifying unit composed of an optical fiber doped with a rare-earth element or alternatively a transition metal and a pumping light source for stimulating said rare-earth element or alternatively said transition metal to thereby bring about stimulated emission,

a compensating light source for generating compensating light having a wavelength within an amplified wavelength band of said optical amplifying unit,

an compensating light coupling device for coupling said compensating light with said plurality of wavelength-multiplexed light signals,

a compensating light branching device for separating mutually the compensating light and the plural wavelength-multiplexed light signals contained in the output of said optical amplifying unit, and

a compensating light control circuit for controlling output power of said compensating light source such that ratio between power of the compensating light outputted from said compensating light branching device and power of the compensating light outputted from said compensating light source assumes a predetermined standard value.

6. An optical amplifying repeater apparatus set forth in claim 1, characterized in that said fixed-gain optical amplifier #1; #n comprises

an optical amplifying unit composed of an optical fiber doped with a rare-earth element or alternatively a transition metal and a pumping light source for stimulating said rare-earth element or alternatively said transition metal to thereby bring about stimulated emission, and

a compensating light control circuit for controlling output power of said compensating light source such that power of spontaneously emitted light outputted from said optical amplifying unit assumes a predetermined standard value.

7. An optical amplifying repeater apparatus set forth in claim 5, characterized in that said fixed-gain optical amplifier #1; #n includes

an adjustable optical attenuator #1'; #n' inserted at an input or output side, whereby means for changing the attenuation factor of said adjustable optical attenuator #1'; #n' in dependence on ambient temperature is implemented.

8. An optical amplifying/repeating transmission system including

a plurality of transmitters for sending out light signals of wavelengths differing one another and carrying information,

a plurality of receivers for receiving said plurality of light signals of mutually different wavelengths, and

a plurality of optical repeaters installed between said

transmitters and said receivers for amplifying said plurality of light signals, and

optical fibers interconnecting said transmitters and said optical repeater, said plurality of optical repeaters, and said optical repeater and said receivers, respectively,

characterized in that said optical amplifying/repeating transmission system comprises

control signal superposing means for superposing a control signal of a specific frequency onto one of said plural light signals,

control signal level detecting means connected to the output of said optical repeater for extracting a part of output power of said optical repeater to thereby detect power of the control signal, and

optical repeater gain control means for controlling gain of said optical repeater so that level of the control signal detected by said control signal level detecting means remains constant.

9. An optical amplifying/repeating transmission system including

a plurality of transmitters for sending out light signals of wavelengths differing one another and carrying information,

a plurality of receivers for receiving said plurality of light signals of mutually different wavelengths, and

a plurality of optical repeaters installed between said transmitters and said receivers for amplifying said plurality of light signals, and

optical fibers interconnecting said transmitters and said optical repeater, said plurality of optical repeaters, and said optical repeater and said receivers, respectively,

characterized in that said optical amplifying/repeating transmission system comprises

control signal generating means for modulating one of said plural light signals with a control signal of a specific

frequency,

control signal level detecting means connected to the output of said optical repeater for extracting a part of output power of said optical repeater to thereby detect power of the control signal, and

optical repeater gain control means for controlling gain of said optical repeater so that level of the control signal detected by said control signal level detecting means remains constant.

10. An optical amplifying/repeating transmission system including

a plurality of transmitters for sending out light signals of wavelengths differing one another and carrying information,

a plurality of receivers for receiving said plurality of light signals of mutually different wavelengths, and

a plurality of optical repeaters installed between said transmitters and said receivers for amplifying said plurality of light signals, and

optical fibers interconnecting said transmitters and said optical repeater, said plurality of optical repeaters, and said optical repeater and said receivers, respectively,

characterized in that said optical amplifying/repeating transmission system comprises

control signal superposing means for superposing a control signal of a specific frequency onto one of said plural light signals,

control signal level detecting means connected to the output of said optical repeater for extracting a part of output power of said optical repeater to thereby detect power of the control signal, and

optical repeater gain control means for controlling gain of said optical repeater so that level of the control signal detected by said control signal level detecting means remains constant,

monitor signal transmitting means for supplying transmission level of said control signal to said optical repeater, and

monitor/control means for receiving a monitoring signal supplied from said monitor signal transmitting means to thereby enable said optical repeater gain control means to operate when said level of said control signal is normal while disabling operation of said optical repeater gain control means with the gain thereof being held when said level of said control signal is abnormal.

11. An optical amplifying/repeating transmission system including

a plurality of transmitters for sending out light signals of wavelengths differing one another and carrying information,

a plurality of receivers for receiving said plurality of light signals of mutually different wavelengths, and

a plurality of optical repeaters installed between said transmitters and said receivers for amplifying said plurality of light signals, and

optical fibers interconnecting said transmitters and said optical repeater, said plurality of optical repeaters, and said optical repeater and said receivers, respectively,

characterized in that said optical amplifying/repeating transmission system comprises

control signal generating means for modulating one of said plural light signals with a control signal of a specific frequency,

control signal level detecting means connected to the output of said optical repeater for extracting a part of output power of said optical repeater to thereby detect power of the control signal, and

optical repeater gain control means for controlling gain of said optical repeater so that level of the control signal detected by said control signal level detecting means remains

constant,

monitor signal transmitting means for supplying transmission level of said control signal to said optical repeater, and

monitor/control means for receiving a monitoring signal supplied from said monitor signal transmitting means to thereby enable said optical repeater gain control means to operate when said level of said control signal is normal while disabling operation of said optical repeater gain control means with the gain thereof being held when said level of said control signal is abnormal.

12. An optical communication system set forth in claim 8, characterized in that said optical repeater gain control means is comprised of an adjustable optical attenuator and means for controlling said adjustable optical attenuator.

13. An optical communication system set forth in claim 8, characterized in that said control signal has a frequency higher than 100 kHz inclusive thereof.

14. An optical communication system set forth in claim 10, characterized in that said monitoring signal has a wavelength shorter than those sent out from said plurality of transmitters.

15. An optical amplifying repeater apparatus for amplifying a plurality of wavelength-multiplexed light signals, comprising

a first fixed-gain optical amplifier for amplifying a plurality of wavelength-multiplexed light signals inputted thereto with a predetermined gain,

a control light signal branching device for extracting a part of power of a control wavelength contained in the output of said first fixed-gain optical amplifier,

an adjustable optical attenuator for attenuating the output of said first fixed-gain optical amplifier by a

predetermined factor,

an adjustable attenuator control circuit for detecting output power of said control light signal branching device to thereby control the attenuation factor of said adjustable optical attenuator so that said detected output power remains constant, and

a second fixed-gain optical amplifier connected to output of said adjustable optical attenuator for amplifying the plural wavelength-multiplexed light signal inputted to said second fixed-gain optical amplifier with a predetermined gain.

16. An optical amplifying repeater apparatus set forth in claim 15, characterized in that the apparatus further comprises an output breaking circuit for stopping amplifying function of said second fixed-gain optical amplifier upon detection of disappearance of output of said control light signal branching device.